

# Minnesota's 2012 National Lakes Assessment: National, State, and Ecoregion-based Approach

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National Water Quality Monitoring Conference:  
2014

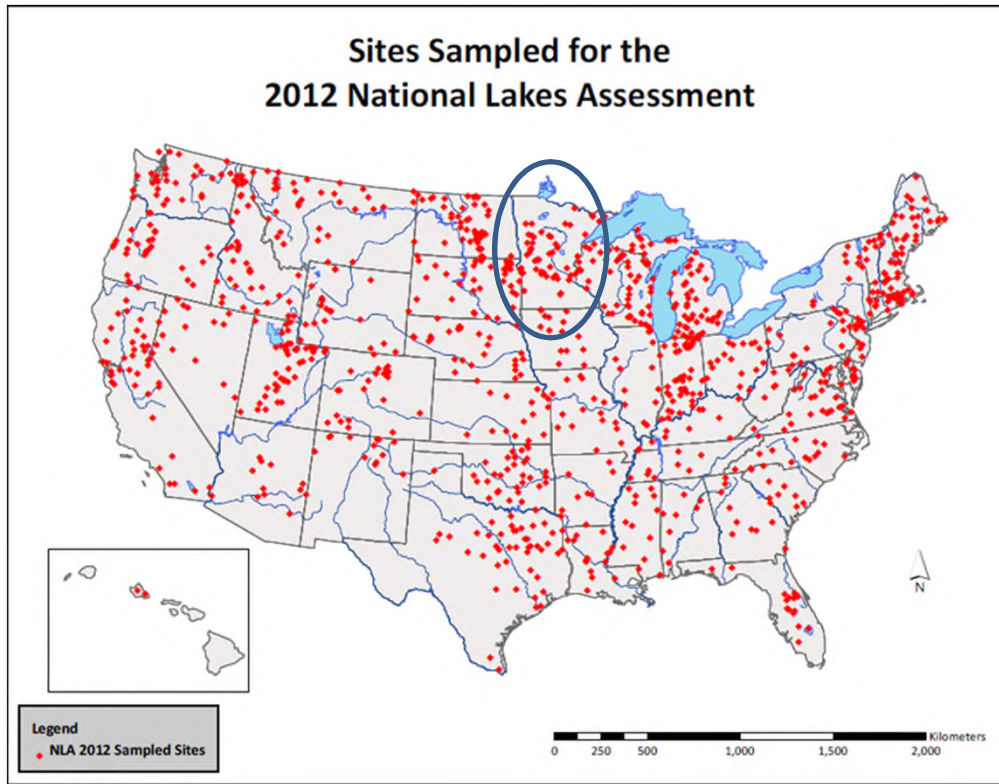


Minnesota Pollution  
Control Agency



# 2012 NLA National & MN Design

- National ~1,000 lakes;
- 2007 resample sites: 398
- 2012 new sites: 506
- Revisit sites: 96
- Minnesota 42 lakes in national frame,
- add 8 for state-based & national;
- 100 for ecoregion-based = 150 total;





# USEPA Questions (*examples*)

1. What is the current condition of the nation's lakes nationally and regionally?
2. Which stressors are most associated with degraded lake condition?
3. How has the condition of lakes changed since the 2007 National Lakes Assessment?

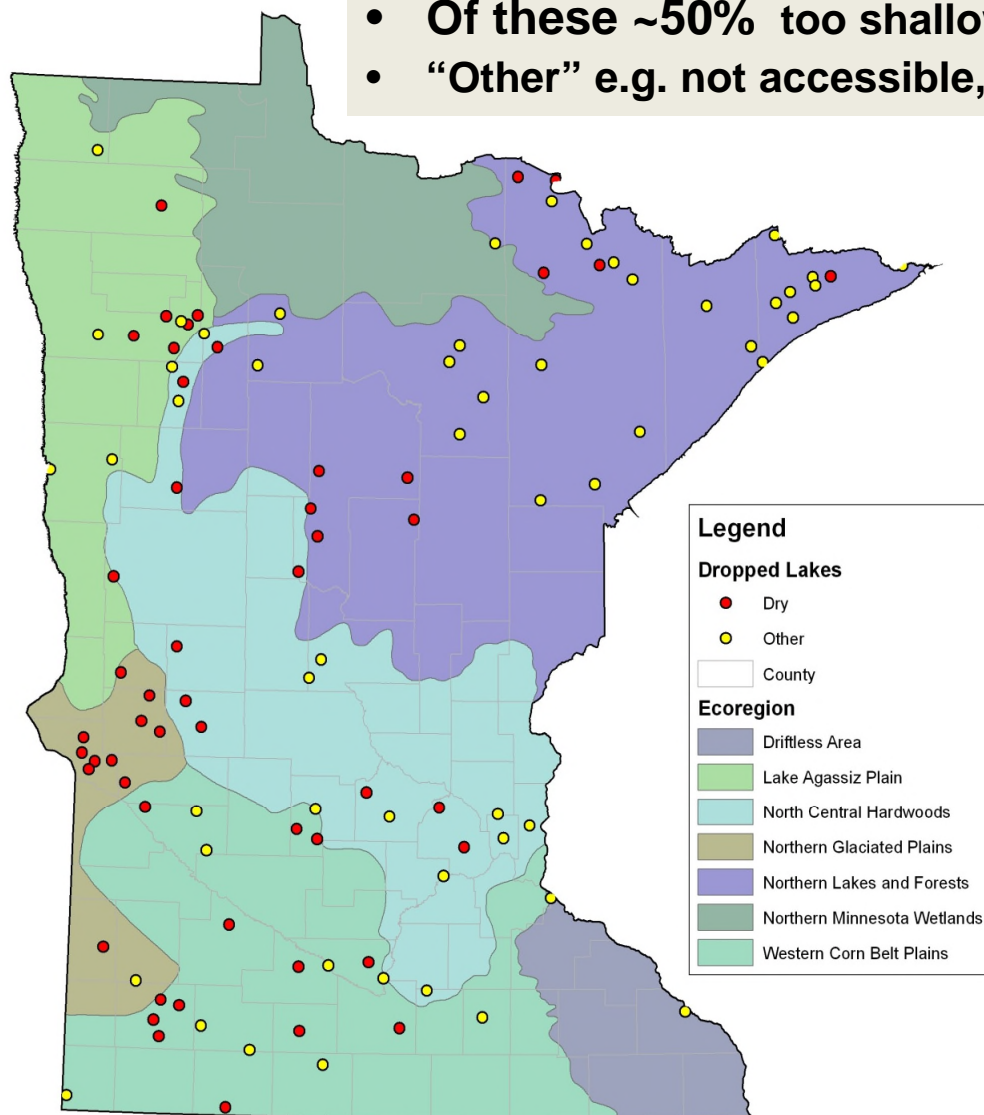


## Minnesota questions

1. How does MN compare to the Nation?
2. How does condition vary among regions?
3. What is the magnitude or detection frequency of pesticides, emerging contaminants & microcystin across the state & among regions?
4. Provide un-biased state & regional descriptions of water chemistry, zooplankton, microcystin and other measures

## Summer 2012 Survey Challenges: severe storms & drought

- **Dropped ~ 100 lakes from 2012 survey.**
- **Of these ~50% too shallow, no open water, or completely dry (red).**
- **“Other” e.g. not accessible, access denial & non-target,**





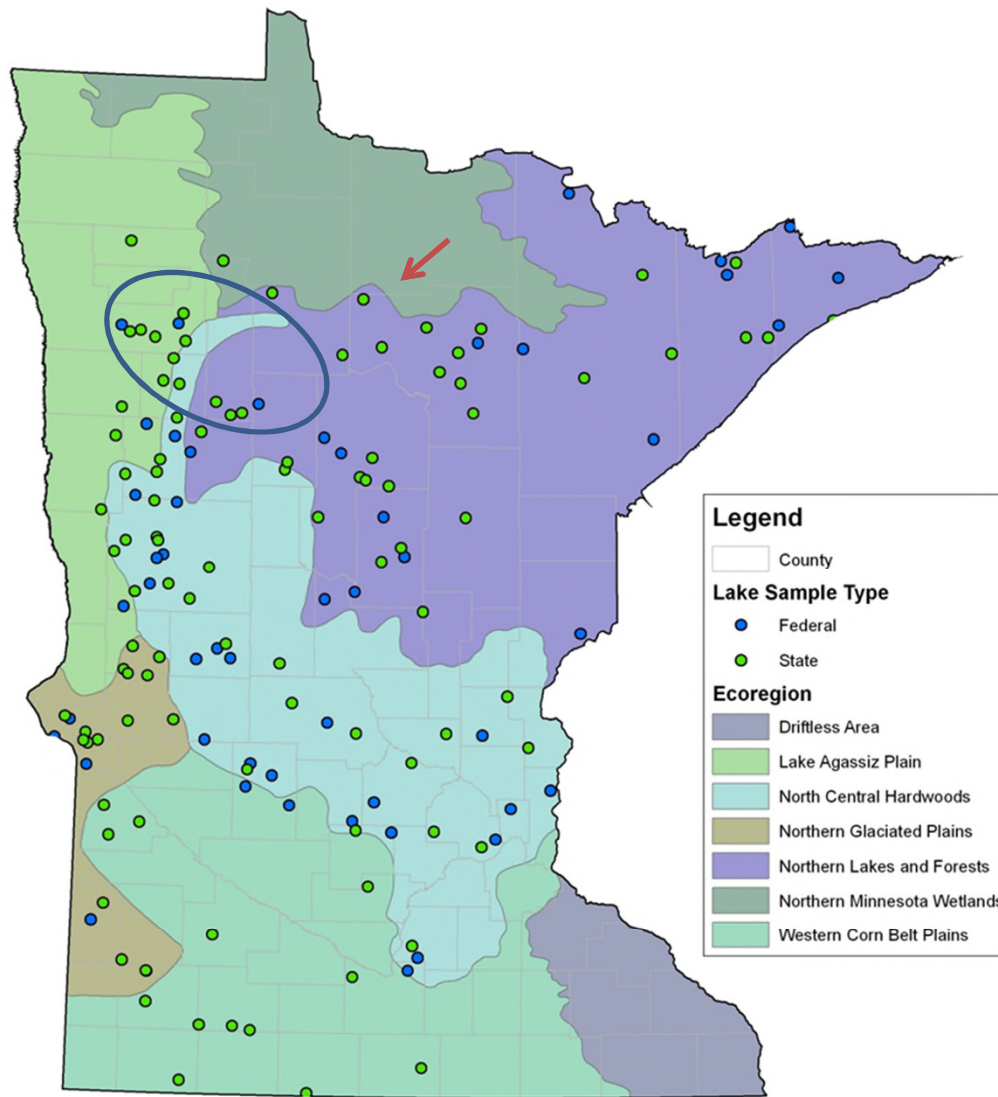
# Sampling challenges

- 150 lakes & short index period (June-Sept. 2012)
- National lakes often needed a full-day & two crews;
- Access determined watercraft selection
- Need for multiple teams in field each week





## Map of 2012 Minnesota NLA lakes



## Collaboration with partners was essential

- Several lakes on White Earth Res., Band advised on access & landowner contacts;
- Two lakes on Red Lake Res., Band helped sample;
- Several lakes in BWCAW – USFS assistance;
- Difficult access northern lakes, MDNR assistance;

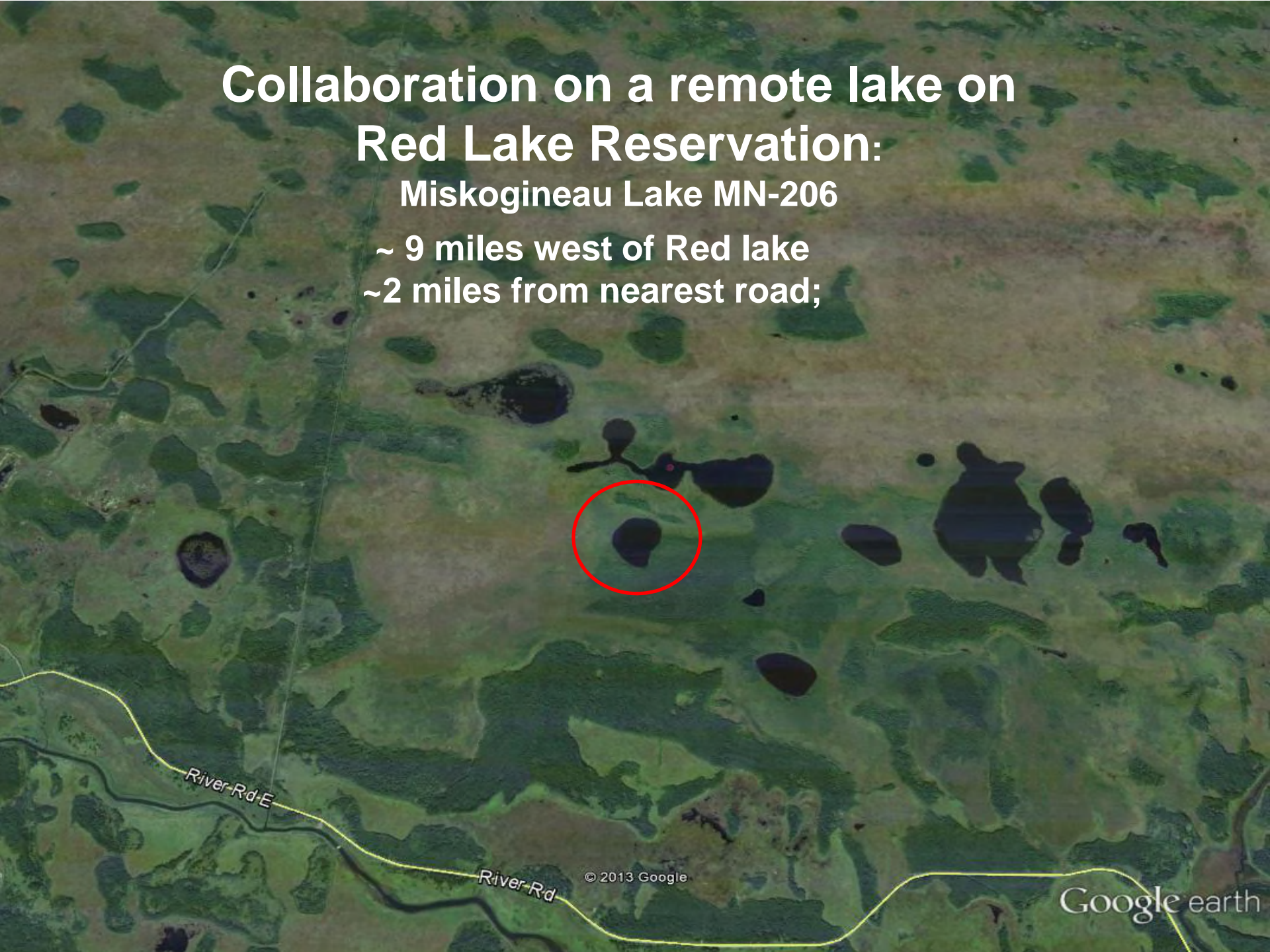


# Collaboration on a remote lake on Red Lake Reservation:

Miskogineau Lake MN-206

~ 9 miles west of Red lake

~2 miles from nearest road;





**Collaboration: Red Lake Natural Resources Dept. (Shane Bowe) facilitated access & assisted with sampling;**





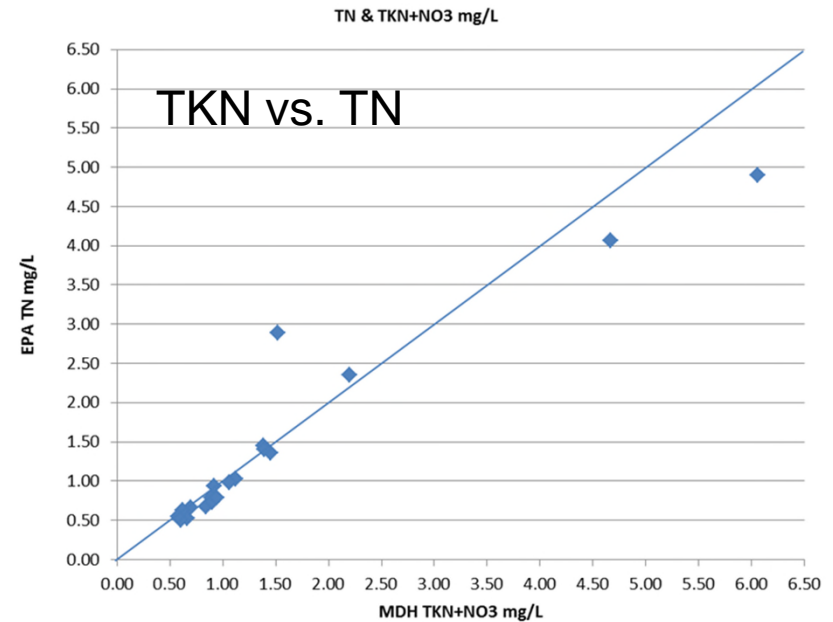
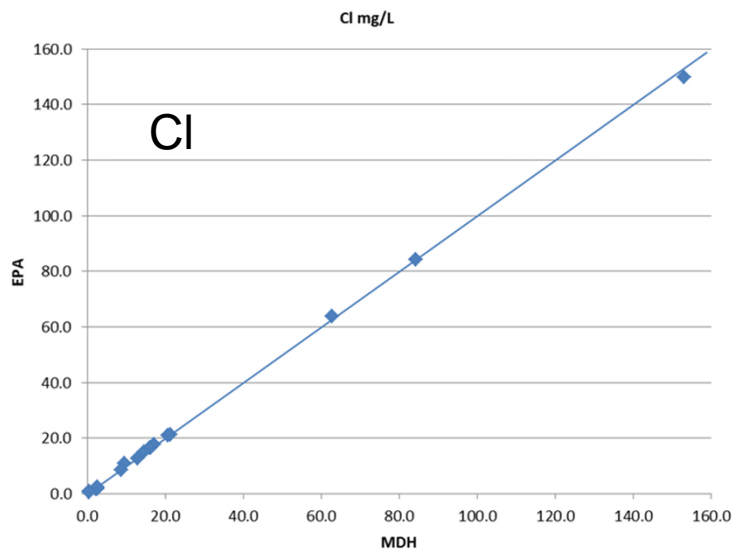
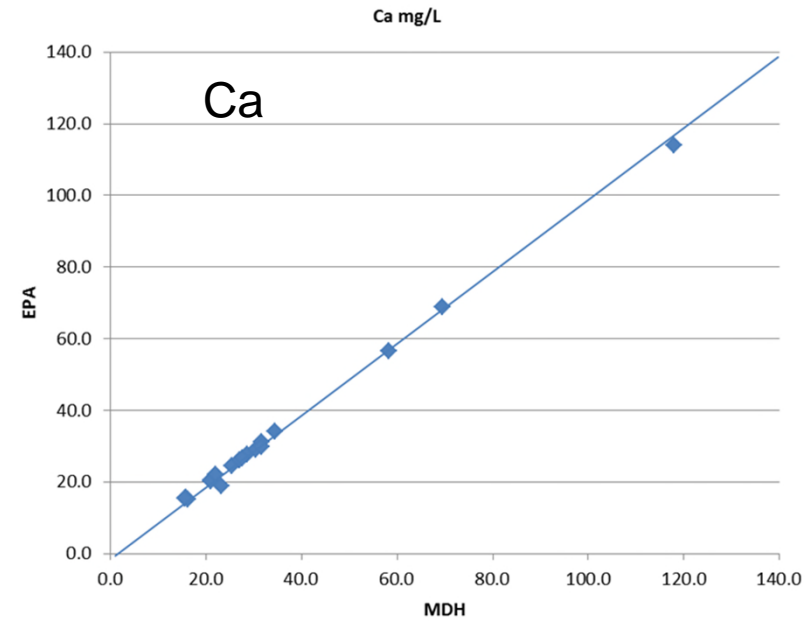
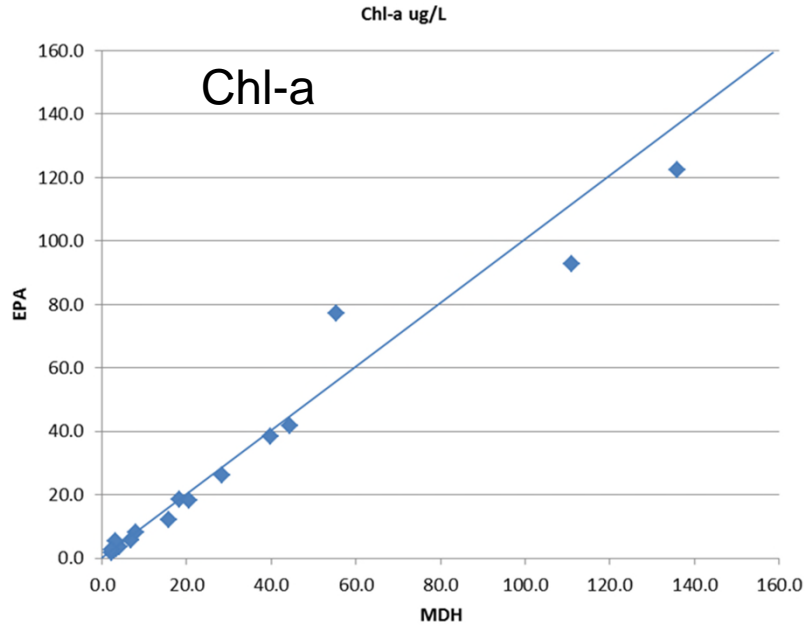
# Analysis & results to date

- Melding EPA & MN data for analysis;
- Examples from EPA Excel Data viewer (beta version) from John Kiddon, ERL Atlantic Division;
  1. Regional patterns in nuisance bloom frequency
  2. Regional cumulative distribution functions
- Regional patterns in microcystin, detection frequency
- Statewide patterns in pesticide concentrations & detections;
- Emerging contaminants detection frequency & patterns;
- Statewide assessment of zooplankton



# Comparison of MDH & EPA ERL WQ data: good correspondence.

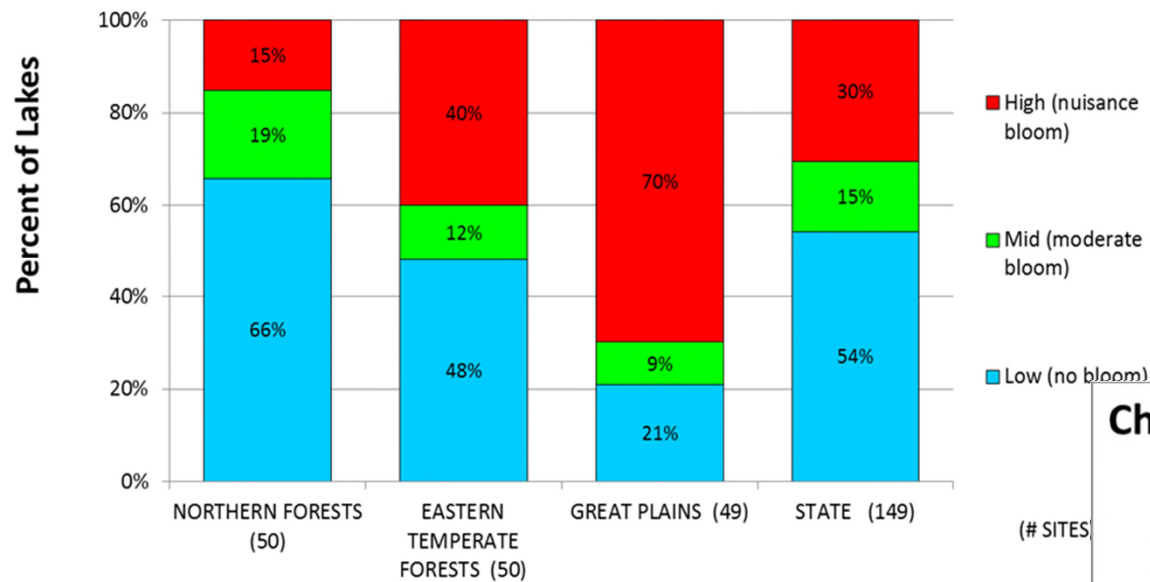
## Examples: Chl-a, Ca, Cl & TN/TKN





Chl-a ( $\mu\text{g/L}$ )

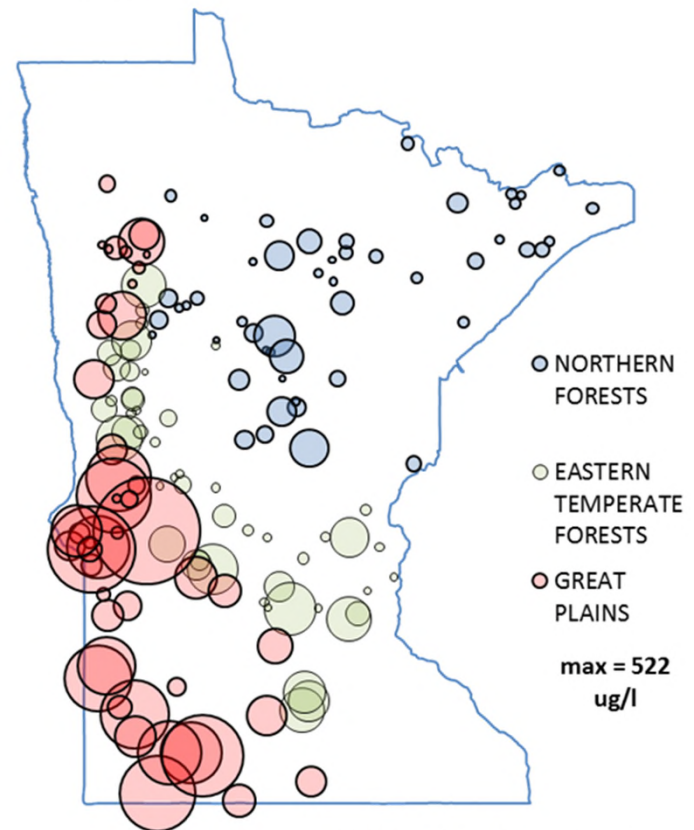
MN 2012 National Lakes Assessment



**Extent & regional patterns in frequency of nuisance algal blooms (Chl-a >20 ppb)**  
*[Data viewer based on weighted samples]*

Chl-a ( $\mu\text{g/L}$ )

(# SITES)

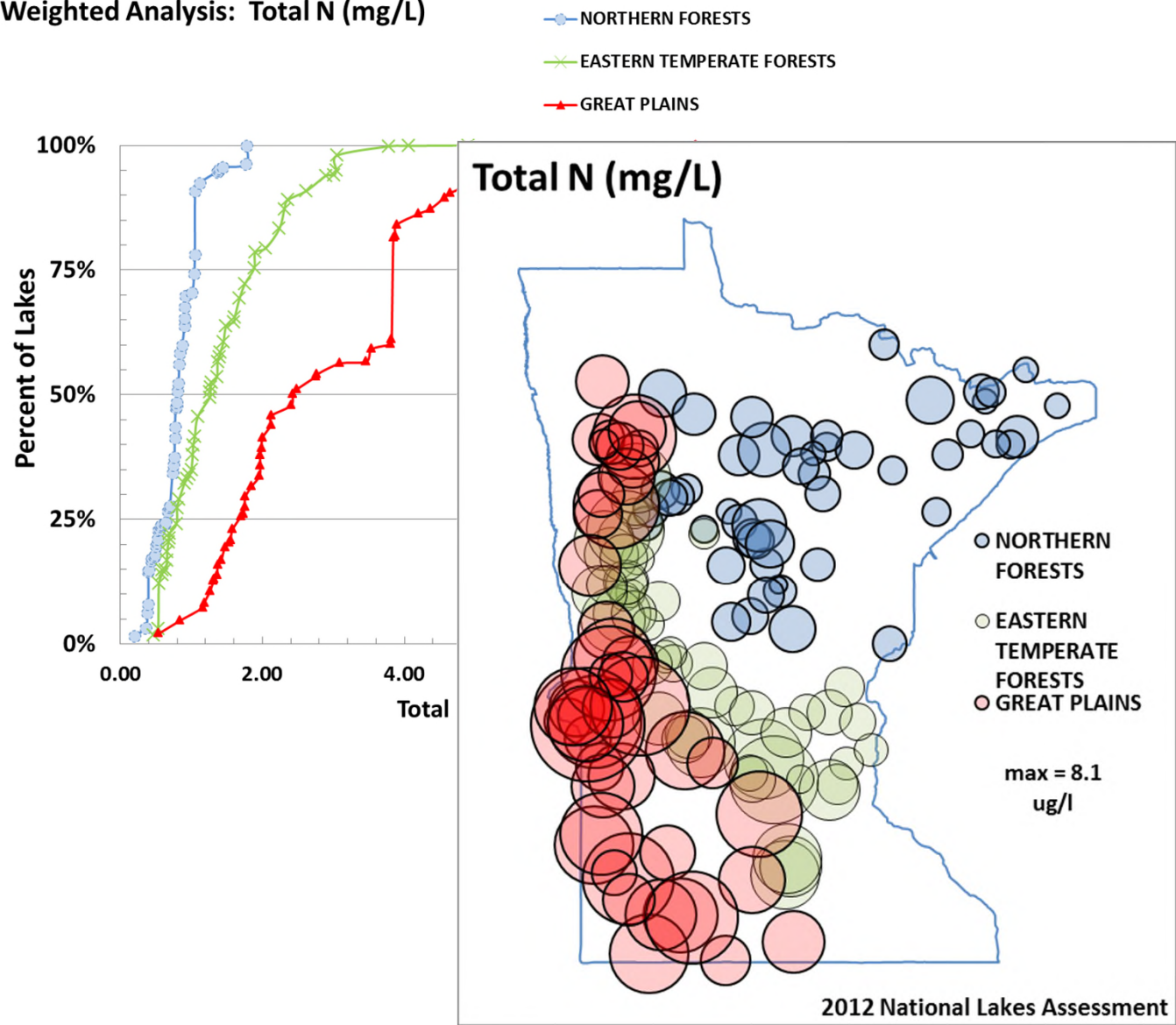


2012 National Lakes Assessment

# What are the regional patterns in TN?

(Data viewer CDF & bubble plots)

Weighted Analysis: Total N (mg/L)



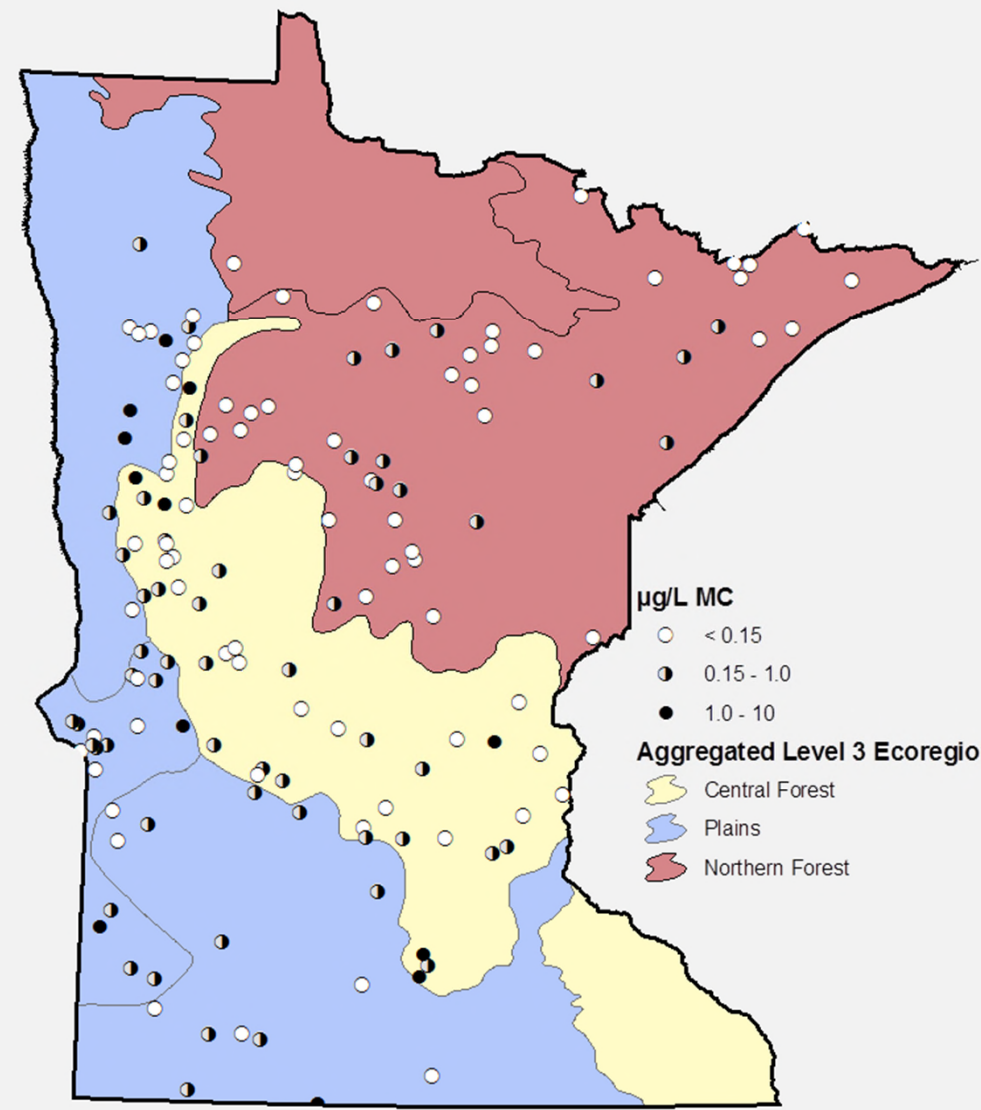


Microcystin (150 mid lake & 50 mid & near)

- 1. W
- mea
- 2. A

Percent of Lakes

100  
80  
60  
40  
20  
0



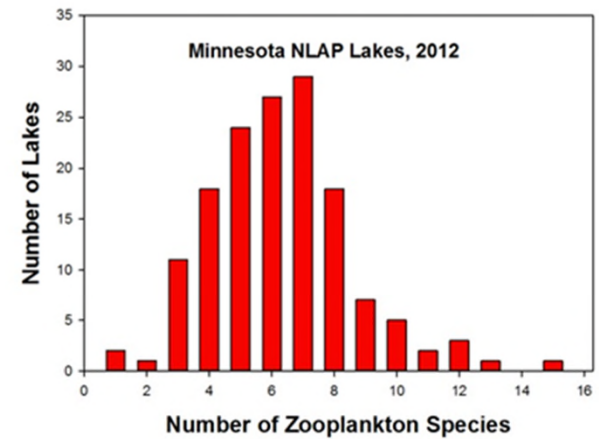
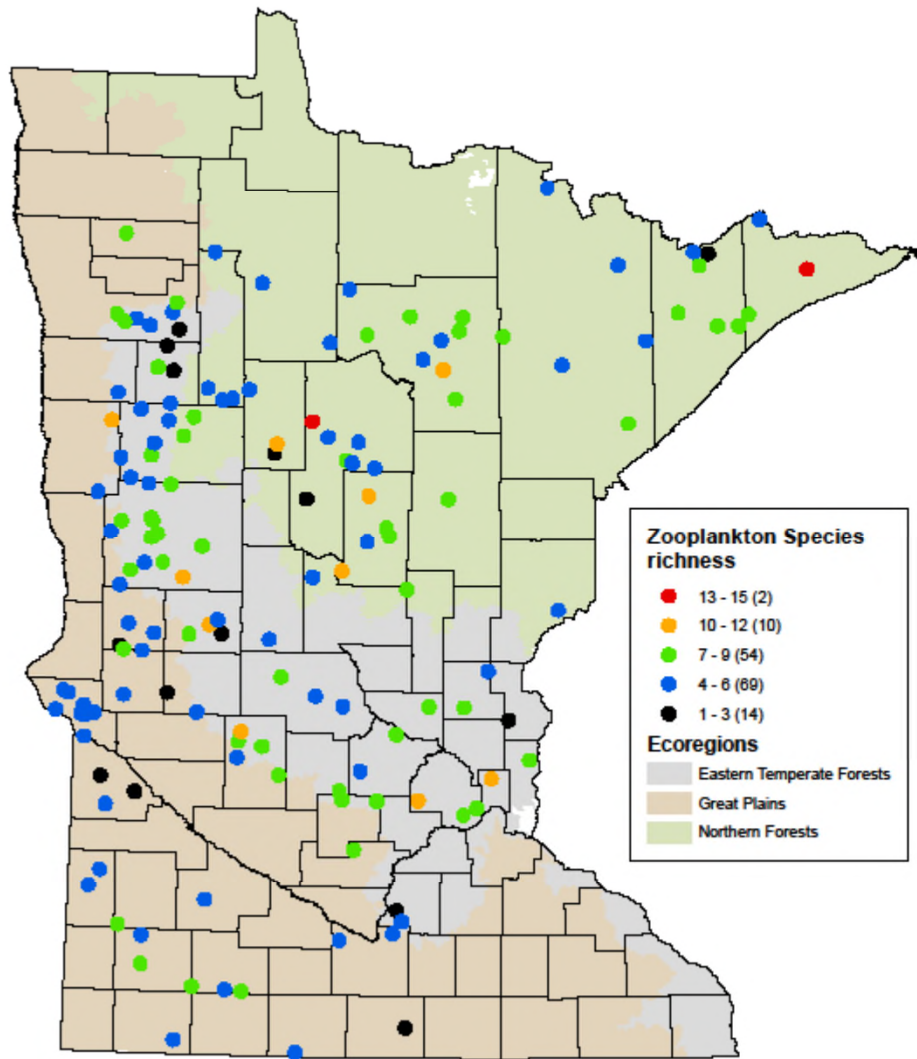
µg/L MC  
○ < 0.15  
● 0.15 - 1.0  
● 1.0 - 10

Aggregated Level 3 Ecoregions  
Central Forest  
Plains  
Northern Forest

1.0)  
i)



## Zooplankton Species Richness (number of taxa) in Minnesota NLAP Lakes 2012



- 150 lakes w/ 80 um mesh net;
- 51 crustacean zooplankton sp. identified including 33 cladocerans & 18 copepods;
- Number of sp from 1 to 15;
- Average species richness was statistically higher in Northern Forest & Eastern Temperate Forest Ecoregions than in Great Plains Ecoregion

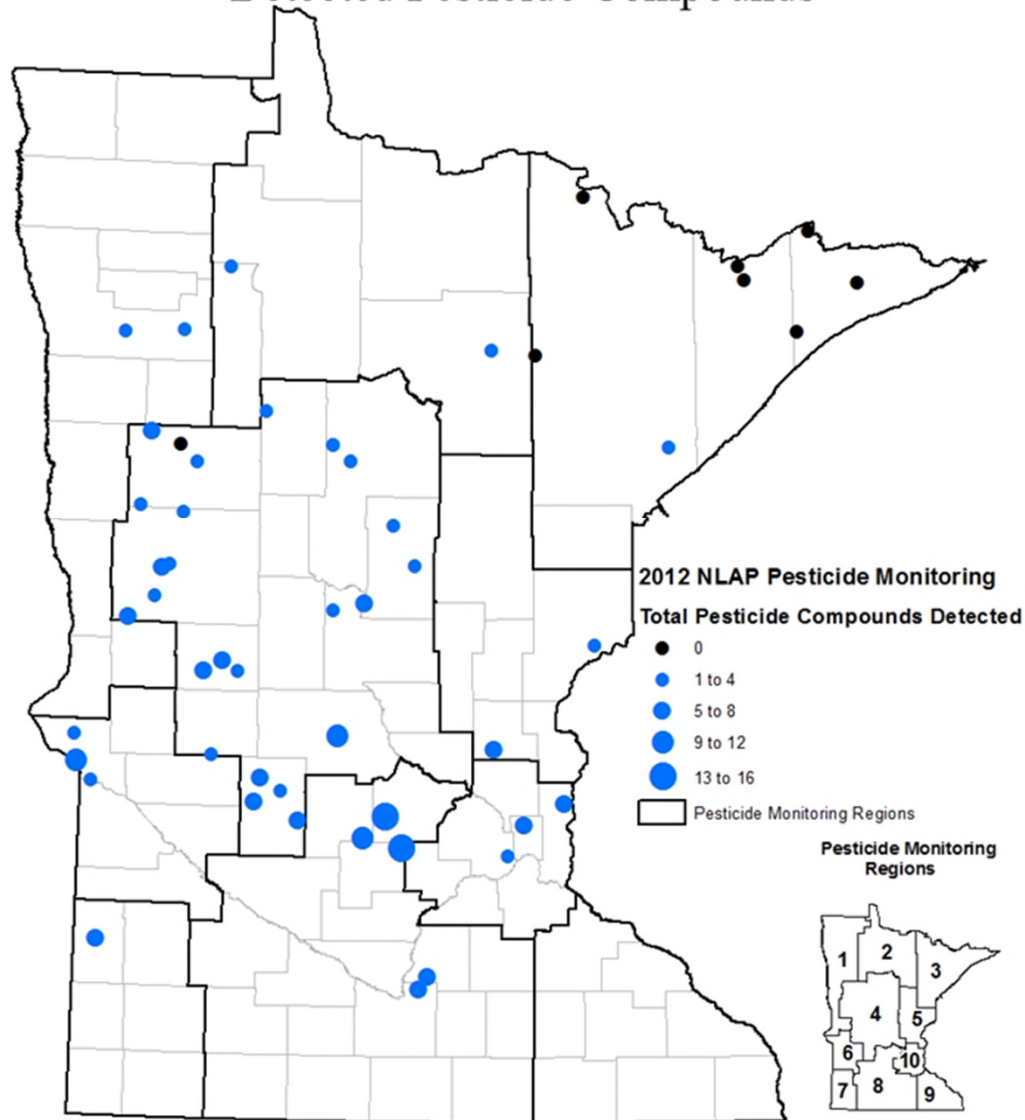


# Pesticides: Collaboration with MDA

Sampled for broad suite on 50 & triazine assay on all 150

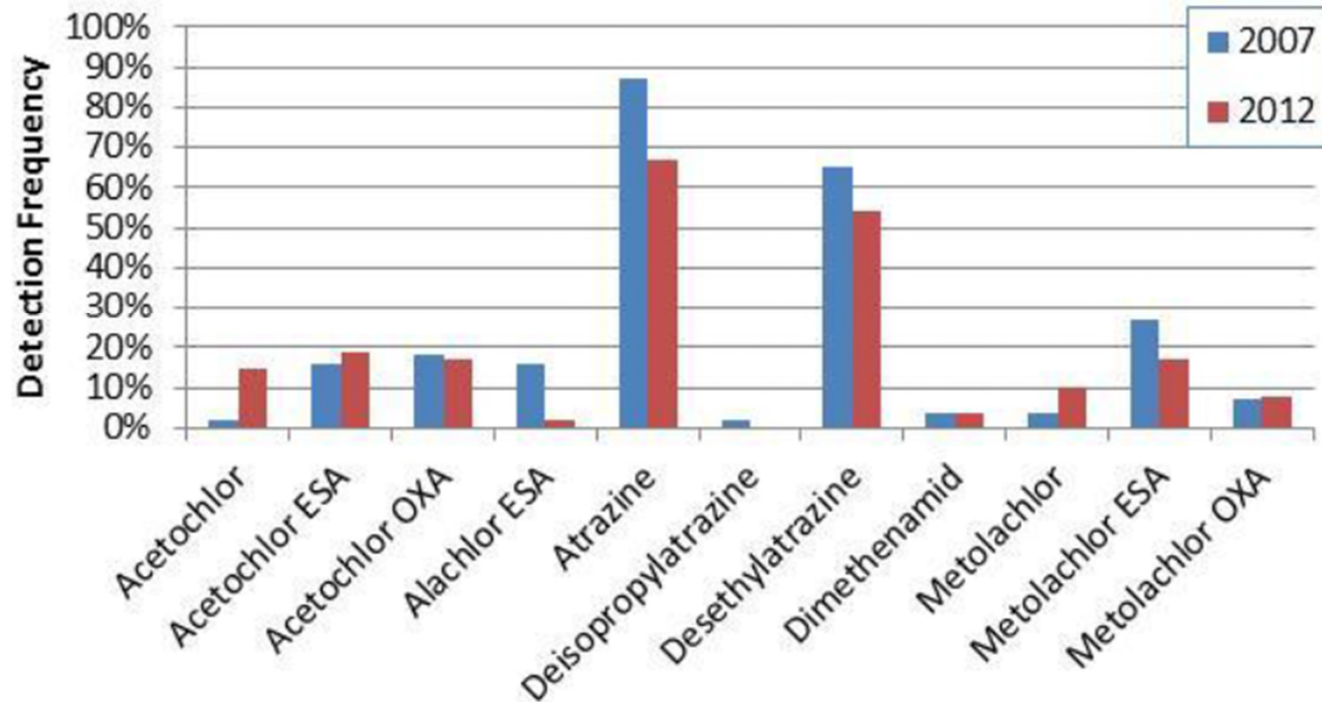
2012 NLAP: GC-MS and LC-MS/MS

Detected Pesticide Compounds



1. Detections low in northern MN;
2. Higher near usage of products;
3. Atrazine (67% detect in 2012) & degradate most frequently detected;
4. All found at very low levels: Atrazine max. 0.22 ug/L vs. 10 ug/L aquatic life WQS;

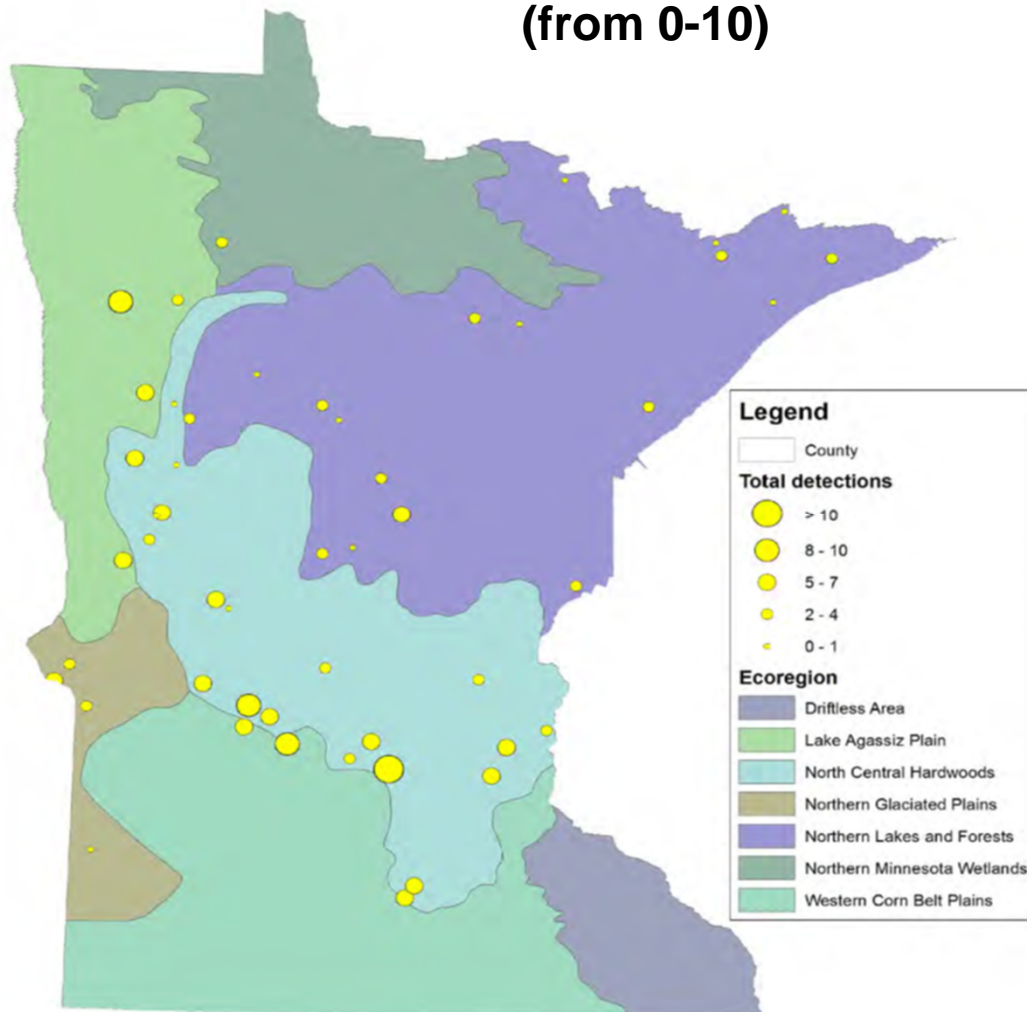
2007 vs 2012 NLA MDA Detection Frequency





# Emerging contaminants

**Total detections  
(from 0-10)**



a) 125 chemicals, including pharmaceuticals & endocrine active chemicals (EAC) sampled for in 50 lakes (note ng/L levels);

b) DEET – most common detection at 76%;

c) Others:

**Bisphenol A,  
Cocaine,  
Androstenedione,  
Carbadox &  
Amitriptyline;**

d) No significant associations with specific land use categories; however, # of detections increases w/ increase in “disturbed (cult+urban) land use”

# MN 2012 NLA Reporting

- Lake-specific reports for collaborators & property owners (underway);
- MPCA report on emerging contaminants (done)
- MDA report on pesticide and triazine assay data (done);
- MS on Microcystin; compares findings from random & targeted surveys (accepted) [*One finding – No significant difference in pelagic vs. near shore MC based on 2012 NLA*];
- MDNR report on zooplankton for 150 lakes -- allow for statewide and ecoregion-based (draft)
- MDNR will analyze physical-habitat data from 2007 & 2012 NLA surveys.
- MDNR - Macrophyte forms, relative abundance, and depth of colonization assessed as part of P-Hab work on 50 lakes.
- Statewide and ecoregion-based report on lake condition & water chemistry.





# Minnesota's NLA 2012

## MPCA 2012 Team

**Leads:** *Pam Anderson, Jesse Anderson, Lee Engel,  
Kelly O'Hara, Dereck Richter, & Steve Heiskary*

**Assist:** *Amy Garcia, Courtney Ahlers-Nelson,  
Mike Kennedy, Andrew Swanson &*

**Interns:** *Will Long & Ben Larson*

**MDNR, MDH, & MDA**

**USFS & NPS**

**White Earth Band Natural Resources**

**Red Lake Band Natural Resources**

**USEPA**

**(questions, data & assistance)**

***John Kiddon***

***Dave Peck***

***Tony Olsen***

***MN NLA page:***

**<http://www.pca.state.mn.us/qzqh141c>**

